PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
030255WO		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US04/08285	17 March 2004 (17.03.2004)	18 March 2003 (18.03.2003)

International Patent Classification (IPC) or national classification and IPC

IPC(8): G06T 11/20 and US Cl.: 345/440

Applicant

QUALCOMM INCORPORATED

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 12 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of ___ sheets.

3. This report contains indications relating to the following items:

   I ☒ Basis of the report

   II ☐ Priority

   III ☐ Non-establishment of report with regard to novelty, inventive step and industrial applicability

   IV ☐ Lack of unity of invention

   V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

   VI ☐ Certain documents cited

   VII ☐ Certain defects in the international application

   VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
18 October 2004 (18.10.2004)	02 February 2006 (02.02.2006)
Name and mailing address of the IPEA/US Mail Stop PCT, Attn: IPEA/ US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Authorized officer Michael Razavi Telephone No. 571-272-4000

Form PCT/IPEA/409 (cover sheet)(July 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US04/08285

I. Basis of the report

1. With regard to the **elements** of the international application:*

☒ the international application as originally filed.

☒ the description:
pages 1-9 as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

☒ the claims:
pages 10-15, as originally filed
pages NONE, as amended (together with any statement) under Article 19
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

☒ the drawings
pages 1-4, as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

☐ the sequence listing part of the description:
pages NONE, as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination(under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in printed form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of

☐ the description, pages NONE

☐ the claims, Nos. NONE

☐ the drawings, sheets/fig NONE

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

** Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*
*** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.*

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US04/08285

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. STATEMENT

Novelty (N)	Claims 13, 15-17, and 29	YES
	Claims 1-12, 14, 18-28	NO
Inventive Step (IS)	Claims NONE	YES
	Claims 1-29	NO
Industrial Applicability (IA)	Claims 1-29	YES
	Claims NONE	NO

2. CITATIONS AND EXPLANATIONS
Please See Continuation Sheet

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

V. 2. Citations and Explanations:

Claims 1-12, 14, and 18-28 lack novelty under PCT Article 33(2) as being anticipated by Regan, U.S. Patent No.: 6,407,736.

In regards to claim 1, Reagan teaches a front end graphics processor (64) and a back end graphics processor (70), which specifically are rendering engines. Regan also teaches a real-time system for rendering a plurality of triangle in competition at a given pixel location using pipelined pixel generation based on the contents of the triangle buffer (Col. 6, lines 43-61 and Col. 14, lines 8-25). In other words, then a plurality of triangles are competing to be rendered, the system determines the visible triangles to be rendered, which specifically is selectively rendering the pixels that fall into said triangles. In order to determine which triangles to selectively render, said system of Regan teaches using bounding boxes as coverage masks (vertices are determined) and triangle buffer writing scheme (Col. 14, liens 26-49; Col. 26, line 64 - Col. 28, line 44; Col. 30, line 58 - Col. 34, line 19 and FIGS. 3. 5, 11, 13-14 and 16). Said bounding box specifically is a rectangular area of pixels that bounds a triangular area of the pixels, which is used to evaluate coordinates associated with the pixels of the rectangular area.

In regards to claim 2, Reagan teaches using the vertices to determine a plurality of triangle parameters comprising color, texture, plane equation, orientation, location on the screen, shape and size (Col. 24, line 56 - Col. 25, line 14; Col. 25, lines 11-29; and Col. 28, line 46 - Col. 32, line 28). Said plane equation and size of the triangle specifically provide the edges of the triangular area. In addition, said edges of the triangle comprise lines connecting two vertices, which specifically are described or determined using linear equations. Thus, determining the size and shape of said triangles specifically is using linear equations to determine the edges of the triangles.

In regards to claims 3 and 4, Reagan teaches computing a coefficient matrix for computing linear coefficients for the set of linear equations (Col. 28, line 45 - Col. 30, line 57) by implementing the Z-plane equations. Said Z-plane equations are applied to determine the shape, size and orientation of the triangle, which specifically is determining the pixels that fall within said triangle. Said equations of claim 4 specifically are taught by Reagan's Z-plane equations, wherein the size, shape and orientation of said triangle are determined to be bounded by the bounding box.

In regards to claim 5, Reagan teaches using said Z-plane equations to determine the visible triangle amongst the plurality of triangles by determining the depth values of each triangle (Col. 28, line 45 - Col. 32, line 27). Thus, only the visible pixels located within the visible triangle are "selectively" rendered after applying said Z-plane equations to each triangle (and corresponding pixels).

In regards to claim 6, Reagan teaches that the system determines the z-plane and color plane equations so that the system can use the slope information to obtain an accurate z-depth and color information at various points on the triangle. Said various points specifically are pixels that fall within said triangle (Col. 29, lines 63-66 and Col. 31, line 36 - Col. 32, lines 28).

In regards to claims 7 and 8, Reagan teaches z-plane equations ($z = Ax + By + C$), which specifically is calculating the vertices ($v=AXc + Byc +C$) as applied to claims 1-5 above, and in order to solve the linear equations (z-plane or vertices), said matrices and inverse matrices must be calculated. In addition, said linear equations are applied to all pixels in order to render the visible pixels of triangles as applied above.

In regards to claim 9, Reagan explicitly teaches a z-buffer as recited in the instant claim (Col. 18, lines 46-61; Col. 30, line 59 - Col. 32, line 28; Col. 66, line 61 - Col. 67, line 61 and FIG. 28, Nos. 940 and 950).

In regards to claim 10, Reagan teaches a geometric processor, which specifically is a control unit, that performs coordinate transformations and provides triangle data to the triangle buffer (FIG. 4; Col. 16, lines 23-65). Said triangle data comprises reordering the vertices, which specifically is specifying the vertices of the triangular area.

~~In regards to claim 11, Reagan teaches said triangle buffer as applied to claims 9-10 above, which specifically buffers triangle~~

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

information comprising information at the vertices. In addition, Reagan explicitly teaches generating a bounding box (FIG. 5 and 20; Col. 28, lines 34-44; Col. 46, line 43 - Col. 48, line 21). Further, Reagan teaches a rasterization unit (30), which identifies triangles that are in competition for a given pixel location, determines visibility of the triangles at that pixel location and selects the winning triangle for said pixel location based on the calculated z-value (Col. 16, lines 48-65; Col. 49, lines 9-23). Thus, said rasterization unit selectively renders said pixels that fall within the triangle via evaluations of the coordinates associated with the pixel values.

In regards to claim 12, Reagan teaches an column of coefficient evaluators (706) via bus (701), which receives the 3D triangle data (coordinates). Slope information (dx/dy for all three line segments bounding the triangle), current screen row, current column, the bcoeff information, and the plane equations to generate 2D span information (i.e., the left and right edges of the triangle). Thus, said coefficient evaluators specifically describe edges of the triangular area (Col. 56, line 29 - Col. 58, line 57) via generating the span, z_s and dz information. Said span is used to determine the left and right edges of the triangle, which is used to determine if the current pixel location is inside or outside of the competing triangle for that location. In addition, as applied to claims 5-6 above, attributes coefficients (z-depth, color, and texture) are determined. Further, Reagan explicitly teaches an rasterizing unit for determining the winning triangle using the z-values calculated using said z-plane linear equations as applied claim 11 above. Thus the teachings of Reagan functions all limitations of the edge coefficient generator, an attribute coefficient generator, and the rasterizer.

In regards to claim 14, Reagan explicitly teaches that the entire system can be optimized to utilize one or a small number of ASICs (Col. 6, lines 30-61 and Col. 67, line 51 - Col. 68, line 35).

In regards to claim 18, the same basis and rationale for claims 1 and 5 above are applied. Said limitations of instant claim are directed to the same limitations as recited in claims 1 and 5.

In regards to claim 19, the same basis and rationale for claims 2 and 18 above are applied. Said limitations of instant claim are identical to claim 2.

In regards to claim 20, the same basis and rationale for claims 3 and 19 above are applied. Said limitations of instant claim are identical to claim 3.

In regards to claim 21, the same basis and rationale for claims 4 and 20 above are applied. Said limitations of instant claim are identical to claim 4.

In regards to claim 22, the same basis and rationale for claims 5 and 18 above are applied. Said limitations of instant claim are identical to claim 5 above.

In regards to claim 23, the same basis and rationale for claims 6 and 22 above are applied. Said limitations of instant claim are identical to claim 6.

In regards to claim 24, the same basis and rationale for claims 7 and 22 above are applied. Said limitations of instant claim are identical to claim 7.

In regards to claim 25, the same basis and rationale for claims 8 and 24 above are applied. Said limitations of instant claim are identical to claim 8.

In regards to claims 26 and 27, the same basis and rationale for claims 9 and 18 above are applied. Said limitations of instant claim are identical to claim 9 above.

In regards to claim 28, Reagan teaches the method of claim 18 above. In addition, Reagan teaches determining the bounding box information (FIGS. 3, 5, 11A-11E, and 16; Col. 23, line 17 - Col. 28, line 44). In order to determine the smallest bounding box for a triangle, said opposite corners of said bounding box must be determined.

Claims 15 and 29 lack an inventive step under PCT Article 33(3) as being obvious over Reagan.

In regards to claims 15 and 29, Reagan teaches scan-out processors and logic (FIG. 2, No. 72; FIG. 21-25, No. 705; Col. 14, lines 26-49; Col. 48, line 22 - Col. 50, line 62), which specifically include a triangle cache. Said triangle cache receives 3D triangle data and z-plane equations, which specifically are pixel data. Even though Reagan does not explicitly teach cache blocks, said triangle cache must have a block size since all memory cache can be configured to have block sizes. Reagan teaches the triangle buffer, which is a 640x480 memory array, having 640 cells. Said cells are memory blocks. FIGS 21-25 explicitly teaches a plurality of memory blocks, which make up the triangle cache. Further, since Reagan teaches that the smallest bounding box is determined for a triangle (Col., 24, lines 53-67; FIG. 5), said bounding box specifically is defined as a function of the triangle and thus as a function of the block size.

Claims 13 and 16-17 lack an inventive step under PCT Article 33(3) as being obvious over Reagan in view of Antochi et al.

In regards to claim 13, Reagan teaches the apparatus of claim 1. Reagan does not explicitly teach a wireless communication device. It is, however, well known in the art that wireless communication devices such as PDAs, laptops, and mobile phones now have 3D graphic rendering system incorporated within. An analogous art, Antochi et al. explicitly teaches performing 3D graphic rendering using tiled rendering of triangles (Pages 1-2), wherein said triangle rendering is performed on mobile phones, PDAs, etc. Said PDAs and mobile phones specifically are wireless communication devices. Since power consumption is an important issue on wireless communication devices, Antochi et al. teaches a low-power tile-based rendering. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to take the teachings of Reagan and to add from Antochi et al. the teachings of low-power tile-based rendering in order to apply the well known raster scan display on wireless communication devices in order to display vibrant 3D graphics without consuming too much power, which allows the wireless device to be used longer.

In regards to claim 16, Reagan teaches a processor to generate video output data for presentation by the display as a graphical environment (FIG 2, Nos. 60 and 70; Col. 16, line 66 - Col. 18, line 61); and a rendering engine that applies a direct evaluation algorithm to render a triangle for the graphical environment, wherein the direct evaluation algorithm applies linear equations to render the triangle without interpolating between edges of the triangle (See claim rejections 1-5 above). As applied above, Reagan explicitly teaches

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(To be used when the space in any of the preceding boxes is not sufficient)

selectively rendering pixels corresponding to the winning triangle based on the z-plane equations, which specifically are linear equations. Said z-plane equations do not interpolate between edges of the triangle. Reagan does not explicitly teach a mobile communication device, but Antochi et al. explicitly teaches applying low-power tile-based rendering on mobile phones as applied to claim 13 above. It would have been obvious to one of ordinary skill in the art at the time of the invention to take the teachings of Reagan and to modify it to add from Antochi et al. the low-power tile-based rendering in order to reduce power consumption as applied to claim 13 above.

In regards to claim 17, the same basis and rationale for claims 10 and 16 above are applied. Said limitations of instant claim are identical to claim 10.

Claims 1-29 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.